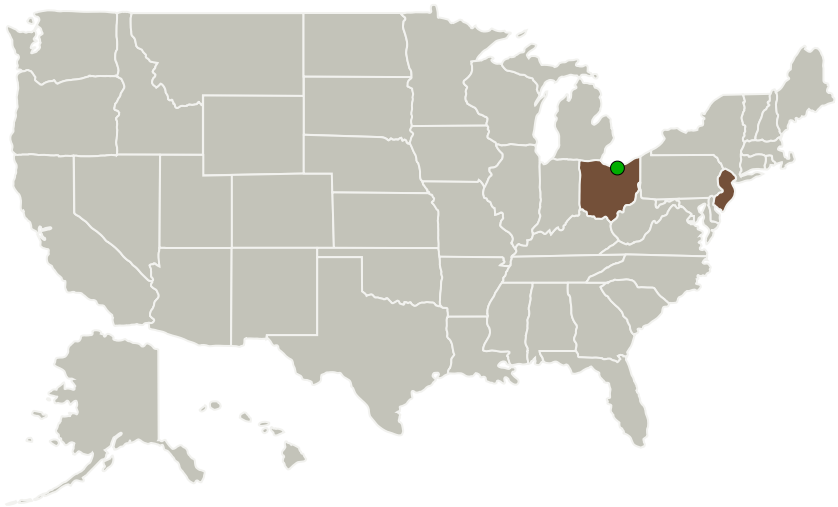
Physics-Based Aeroanalysis Methods for Open Rotor Conceptual Design, Phase I

Completed Technology Project (2015 - 2015)

Project Introduction

Operating costs and fossil fuel consumption of civil transports can be reduced through use of efficient counter rotating open rotor (CROR) propulsion systems, thereby addressing both key industry needs and long-term NASA technical goals. To develop such next-generation systems, multiple design variables must be assessed and optimized efficiently within a conceptual design software environment. A blend of physics-based, low- and mid-fidelity tools featuring rapid turnaround time and ease of setup can provide this capability; implementation represents a serious technical challenge, though, and there is a high premium on developing tools that are both sufficiently accurate to capture current technology performance metrics while permitting the rapid re-calculations necessary for design trades. The proposed approach centers on a blend of enhanced features and novel departures for two complementary aeroanalysis methods: an evolved version of an established subsonic lifting surface free wake mdoel for propellers as a fast,'low-fidelity' tool; and a more computationally intensive, fully compressible Cartesian Grid Euler model as a 'mid-fidelity' tool. The projected Phase I will implement and test key modeling and formulation improvements for these methods to enable them to support the design of multi-stage open rotor configurations to meet current and projected performance targets.

Primary U.S. Work Locations and Key Partners



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Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
Continuum Dynamics, Inc.	Lead Organization	Industry	Ewing, New Jersey
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
New Jersey	Ohio

Project Transitions

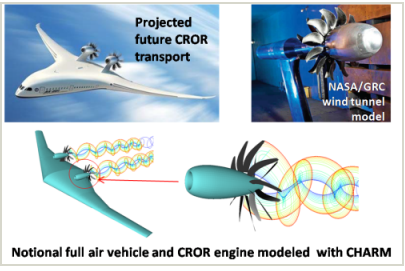
June 2015: Project Start

December 2015: Closed out

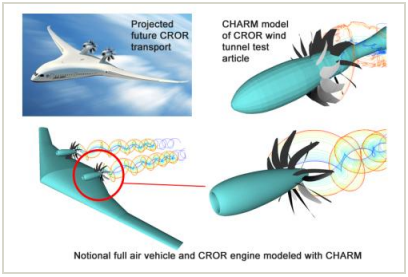
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139217)*

Images



Briefing Chart
Physics-Based Aeroanalysis Methods for Open Rotor Conceptual Design Briefing Chart *(https://techport.nasa.gov/image/134133)*



Final Summary Chart Image
Physics-Based Aeroanalysis Methods for Open Rotor Conceptual Design, Phase I Project Image *(https://techport.nasa.gov/image/134536)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Continuum Dynamics, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Todd R Quackenbush

Co-Investigator:
Todd Quackenbush

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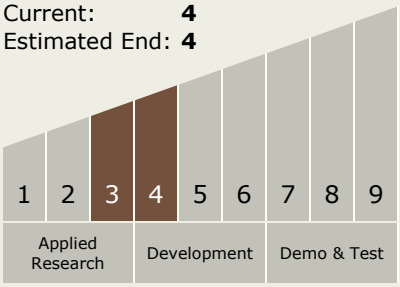
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.8 Ground and Flight Test Technologies

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System